

REMARKS

The Examiner is thanked for the thorough examination and search of the subject.

Claims 55 and 57-65 are pending; Claims 55, 57, 58, 62, 63 and 65 are currently amended; Claims 1-54 and 56 have been canceled. No new matter is believed to be added.

Response to Claim Rejections under 35 U.S.C. 102 and 103

Applicants respectfully traverse the rejections for at least the reasons set forth below.

Response to Claims 55 and 57-65

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As currently amended, independent Claim 55 is recited below:

55. A chip package comprising:

 a semiconductor device;

 a substrate comprising a solder mask and a first pad separate from said solder mask, wherein said first pad is at a horizontal level same as said solder mask is at, and wherein said first pad has a circular shape;

 a metal pillar between said semiconductor device and said first pad, wherein said metal pillar has a thickness between 10 and 100 micrometers;

 an under bump metal layer between said metal pillar and said first pad, wherein said metal pillar has a transverse dimension smaller than that of said under bump metal layer, wherein said metal pillar has a first sidewall recessed from a second sidewall of said under bump metal layer, wherein a distance between said first sidewall and said second sidewall is greater than 0.2

micrometers, and wherein said under bump metal layer comprises a first portion over said metal pillar and a second portion overhanging said metal pillar;

a solder metal between said under bump metal layer and said first pad, wherein said solder metal is bonded to said first pad; and

an underfill between said semiconductor device and said substrate, wherein said underfill contacts with said semiconductor device and said substrate and encloses said metal pillar and said solder metal.

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Reconsiderations of Claims 55 and 57-65 rejected under 35 U.S.C. 103(a) as being obvious over Ohuchi et al. (U.S. Pat. No. 6,495,916) in view of Yoneda et al. (U.S. Pat. No. 6,229,711) are requested based on the following remarks.

Applicants respectfully assert that the chip package claimed in Claim 55 patentably distinguishes over the citation by Ohuchi et al. (U.S. Pat. No. 6,495,916) in view of Yoneda et al. (U.S. Pat. No. 6,229,711).

Ohuchi et al. teach a soldering topping 14 is on a copper post 4 on a semiconductor chip 1 and a solder ball 7 is on the soldering topping 14. ~ See Fig. 7; col. 3, lines 1-3; col. 6, lines 31-36 ~ A resin 5 encloses the copper post 4 and an opening in the resin 5 exposes a top surface of the copper post 4, leading the solder topping 14 to be joined with the top surface of the copper post 4. ~ See Fig. 7; col. 6, lines 37-44 ~

After Ohuchi et al.'s semiconductor chip 1 is joined to a substrate, an underfill could flow into the gap between Ohuchi et al.'s semiconductor chip 1 and the substrate. However, the underfill only encloses the solder ball 7, but does not enclose the copper post 4, because the copper post 4 has been previously enclosed by the resin 5. It is

believed that the subject matter that an underfill encloses a metal pillar having a thickness between 10 and 100 micrometers and a solder metal over the metal pillar, as claimed in Claim 55, cannot be attained by Ohuchi et al.'s semiconductor chip 1. Besides, the resin 5 in Ohuchi et al.'s device can not be omitted, because the solder ball 7 and the solder topping 14, during a reflow process, could collapse to the semiconductor chip 1 if the resin 5 in Ohuchi et al.'s device is omitted.

The Examiner considers that "while Ohuchi fails to teach the distance between an edge of said metal layer and an edge of said metal pillar is greater than 0.2 micrometers, it would have been obvious to one ordinary skill in the art at the time of the invention to optimize this distance through routine experimentation". ~ See lines 5-8, on page 9, in the last Office Action mailed Aug. 17, 2007 ~

Applicants respectfully traverse the Examiner's opinion because it would have been unobvious to one ordinary skill in the art at the time of the invention to optimize this distance. Applicants teach the metal pillar has a first sidewall recessed from a second sidewall of the under bump metal layer, wherein a distance between said first sidewall and said second sidewall is greater than 0.2 micrometers, as claimed in Claim 55. The overhanging under bump metal layer prevents the solder metal over the under bump metal layer from collapsing to a semiconductor device during a reflow process. It is believed that the subject matter that a metal pillar has a first sidewall recessed from a second sidewall of the under bump metal layer over the metal pillar, wherein a distance between the first sidewall and the second sidewall is greater than 0.2 micrometers can not

be anticipated by Ohuchi et al. because Ohuchi et al. fail to teach the above-mentioned motivation.

Yoneda et al. teach a connection pad 20 on a circuit board 12 has a rectangular shape. ~ See Fig. 5 ~ Thus, a solder lump 15 formed on the connection pad 20 could flow onto a wire 19 on the circuit board 12 because the solder lump 15 has a relatively small surface tension if the solder lump 15 is formed on a rectangle-shaped surface of the connection pad 20. However, applicants teach a pad on a substrate could have a circular shape, as claimed in Claim 55 and as shown in Fig. 11. A solder metal joined with the claimed pad could not flow onto an interconnect trace connected to the claimed pad because the solder metal has a relatively great surface tension if the solder metal is joined to a circle-shaped surface of the claimed pad. It is believed that a pad separate from a solder mask has a circular shape, as claimed in Claim 55, can not be anticipated by Yoneda et al. because Yoneda et al. fail to teach the above-mentioned motivation.

For at least the foregoing reasons, withdrawal of the rejection under 35 U.S.C. 103(a) to Claim 55 is respectfully requested.

Applicants respectfully submit independent Claim 55 patently distinguishes over the prior art references, and should be allowed. For at least the same reasons, dependent claims 57-65 patently define over the prior art as well.

Response to Double Patenting

Reconsiderations of Claims 55 and 57-65 provisionally rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over Claims 53, 58, 59 and 67 of copending Application No. 10/935,451 in view of Yoneda et al. are requested based on the following remarks.

The claims as amended are believed to be patentably distinct from the claims of co-pending patent application 10/935,451. Yoneda et al. teach a connection pad 20 on a circuit board 12 has a rectangular shape. ~ See Fig. 5 ~ Thus, a solder lump 15 formed on the connection pad 20 could flow onto a wire 19 on the circuit board 12 because the solder lump 15 has a relatively small surface tension if the solder lump 15 is formed on a rectangle-shaped surface of the connection pad 20. However, applicants teach a pad on a substrate could have a circular shape, as claimed in Claim 55 and as shown in Fig. 11. A solder metal joined with the claimed pad could not flow onto an interconnect trace connected to the claimed pad because the solder metal has a relatively great surface tension if the solder metal is joined to a circle-shaped surface of the claimed pad. It is believed that a pad separate from a solder mask has a circular shape, as claimed in Claim 55, can not be obvious in view of Yoneda et al. because Yoneda et al. fail to teach the above-mentioned motivation.

Reconsiderations of Claims 55 and 57-65 provisionally rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over Claims 1-10 of copending Application No. 11/389,717 are requested based on the following remarks.

A terminal disclaimer in compliance with 37 CFR 1.321(c) is submitted. Withdrawal of the rejection to Claims 55 and 57-65 under double patenting is respectfully requested.

CONCLUSION

Some or all of the pending claims are believed to be in condition for allowance. Accordingly, allowance of the claims and the application as a whole are respectfully requested.

It is requested that should Examiner Zarneke not find that the Claims are now Allowable that he call the undersigned at 845 452-5863 to overcome any problems preventing allowance.

Respectfully submitted,

A handwritten signature in black ink, appearing to be 'SBA', with a long horizontal flourish extending to the right.

Stephen B. Ackerman, Reg. No. 37,761